

Claims

What is Claimed is:

1 1. A process for milling copper metal from a substrate having an exposed copper
2 surface, the process comprising:

3 absorbing a halogen gas onto the exposed copper surface to generate
4 reaction products of copper and the halogen gas;

5 removing unreacted halogen gas from the surface; and

6 directing a focused ion beam onto the surface to selectively remove a
7 portion of the surface comprising the reaction products.

1 2. The process according to Claim 1, wherein the halogen gas consists essentially of
2 iodine.

1 3. The process according to Claim 1, wherein the halogen gas is selected from the
2 group consisting of chlorine, fluorine, iodine and mixtures thereof.

1 4. The process according to Claim 1, wherein removing the unreacted halogen
2 comprises applying an electron beam scan to the surface and at an energy effective for
3 removing the unreacted halogen from the surface.

1 5. The process according to Claim 4, wherein the beam current comprises an energy
2 from about 500 to 3,000 picoAmps.

6. A process for focused ion beam milling multiple layers of a substrate, wherein the substrate comprises an insulating layer in contact with an underlying copper surface, the process comprising:

- exposing the substrate to a noble gas halide within an enclosed chamber;
- directing a focused ion beam onto a portion of the insulating layer and removing the portion to expose the underlying copper surface;
- absorbing a halogen gas onto the exposed copper surface to generate reaction products of copper and the halogen gas;
- removing unreacted halogen gas from the surface; and
- directing a focused ion beam onto the surface to selectively remove a portion of the surface comprising the reaction products.

7. The process according to Claim 6 wherein the halogen gas consists essentially of iodine.

8. The process according to Claim 6, wherein the noble gas halide is selected from the group consisting of XeF_2 , XeF_4 , XeF_6 , KrF_2 , KrF_4 and KrF_6 .

9. The process according to Claim 6, wherein the halogen gas is selected from the group consisting of chlorine, fluorine, iodine and mixtures thereof.

10. The process according to Claim 6, wherein the focused ion beam comprises gallium ions.

11. The process according to Claim 6, wherein removing the unreacted halogen gas comprises applying an electron beam scan to the surface at an energy effective for removing the unreacted halogen from the surface.

1 12. The process according to Claim 6, wherein the beam current comprises an energy
2 from about 500 to 3,000 picoAmps.

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